CHAPTER X

DEVELOPMENT OF AIRCRAFT ARMAMENT

The potential of the helicopter to provide the ground combat soldier additional mobility had long been recognized. During the Korean War the first attempts to use airmobility had been made mainly by the Marines, but the limited number of helicopters and their technical limitations had prevented any conclusive demonstration. As helicopter units became available to the Army, their use was included in field exercises. The first attempts to move units as such were made during Exercises SNOWSTORM in March 1953 and FLASHBURN in April and May 1954.[1]

These exercises proved inconclusive. Strong Air Force opposition to troop transport by Army aircraft further delayed the development of airmobile doctrine. It was apparent that successful airmobile operations required the use of armed helicopters. The arming of helicopters had been proposed in World War II and various attempts had been made during the Korean conflict. The development of a suitable helicopter—the UH-1—and the successful efforts to develop an aerial weapons system laid the foundation of Army airmobility.

Weapons System Development

Project ABLE BUSTER

The Army's interest in arming helicopters and other light aircraft after the Korean War was originally limited to the development of a flying tank destroyer. On 1 February 1955, the Department of the Army requested that CONARC conduct necessary tests to determine the desirability and the feasibility of employing Army aircraft as tank destroyers. The tests were to establish requirements, doctrine, tactics, and techniques which, on confirmation of requirements and feasibility, would lead to the establishment of military characteristics for aircraft more suitable than those presently available to the Army. It was envisioned that these armed light aircraft would be organized into Army Aviation Attack Companies operating in direct support of regimental combat teams and combat commands. Operating against enemy armor, the attack companies were to deliver aerial armaments in a minimum time following a request for support.

CONARC, on 15 April, directed the Army Aviation School to conduct tests, designated Project ABLE BUSTER, during the period 15 April-1 July, to determine the desirability and practicability of the concept so that a decision as to the requirement for subsequent testing could

be reached by 1 July. The Army Aviation School was to make preparations for combined troop testing to be conducted during the period 1 July to 1 September provided the requirement was established by the first phase testing.

The Army Aviation School, utilizing civilian off-the-shelf and Army aircraft to fire munitions including small arms, rockets, and chemicals, conducted tests during May and June and submitted a first interim report on 15 June. For testing, the school had been assigned one T-34 trainer, Fletcher FD-25 and TEMCO M-33 light aircraft in addition to L-19s, L-20s, and L-23s. Helicopters were briefly evaluated, but were rated as poor performers. One of the first problems encountered concerned ordnance. No appropriate aerial rockets were available from Army Ordnance Corps sources. Modern aerial rockets had been designed to be released from aircraft traveling several hundred miles an hour, while the Army's aircraft flew much slower. This problem was never completely overcome, however numerous rockets were tested and it was determined that a fixed fin rocket was the most suitable for this type of launch platform. The Army Aviation School concluded that no aircraft assigned to the Army or any of the special aircraft tested were suitable for the antitank role. The Army use of Air Force or Navy fixed wing aircraft was proposed, but this suggestion was never pursued. The Army Aviation School recommended that a separate project designed to determine requirements and characteristics of an optimum close support aircraft was required.[2]

On 25 October, the Army Aviation School submitted its final report on the feasibility test. The school concluded that employment of light aircraft of types organic to the Army in the antitank role was feasible and recommended the conduct of troop tests with modified civilian aircraft to be procured by the Army. It also recommended that an efficient aerial weapons platform be developed for this one particular mission and not be expected to carry cargo or fly command liaison missions. CONARC nonconcurred with the Army Aviation School recommendations on 7 December, and recommended to the Department of the Army that no further tests be conducted using currently available aircraft and munitions.[3]

Army Aviation School Experiments

The failure of Project ABLE BUSTER and the unfavorable report on the SKY CAV experiment conducted during Exercise SAGE BRUSH resulted in a serious setback to the development of an armed helicopter and of airmobile doctrine. Brig. Gen. Carl I. Hutton, the Commandant of the Army Aviation School, was a firm believer in the future of the armed helicopter. General Hutton's opportunity to proceed on his own with the development of the armed helicopter came in June 1956. On 4 June, CONARC issued Training Memorandum No. 13, Organization and Training for Mobile Task Force-Type Operations, which emphasized the need for new concepts in mobility and flexible organization and required commanders to conduct experiments in this area.

Upon receipt of Training Memorandum No. 13, General Hutton immediately took two actions. First, he asked Col. Jay D. Vanderpool, Chief of the Combat Developments Office of the school to undertake the fabrication and testing of weapons systems to be used on Army

helicopters. Secondly, General Hutton on 27 June wrote to General Wyman that the mobility of task forces was still no greater than it had been during World War II. He believed that the only solution to the problem was putting the soldier into aerial vehicles. At that time, the Army only had aircraft designed as transports, but General Hutton believed that the development of fighting aerial vehicles was necessary. General Hutton requested approval to experiment with existing helicopters, organized into tactical formations, and to run some problems similar to those contained in Training Memorandum No. 13. As far as he had been able to determine there was nothing in the regulations to prohibit this testing, and it was only a question of policy and whether the Army Aviation School should conduct the experiments.

General Wyman agreed on 13 July that air vehicles were a promising means of increasing mobility. He pointed out that the scope of Army aviation in the PENTANA Army represented a great stride forward. Although the quantity and types of aircraft in that army were considered to be state-of-the-art, he felt that no opportunity should be missed to improve on the PENTANA concept. He therefore approved General Hutton's plan and requested that details be submitted to CONARC by 24 August. The plan was to include a statement of the purpose, the objective, and an outline of the method of accomplishment. General Wyman directed that coordination should be made with the Infantry School. He also approved experimentation with existing helicopters to run problems similar to those in Training Memorandum No. 13, providing this effort was coordinated with the Infantry School and that it would in no way retard the accomplishment of the primary mission of the Army Aviation School. General Wyman did not tell General Hutton to use armed helicopters, nor did he tell him not to use them.[4]

On 23 August, the Army Aviation School published its proposal, entitled The Armed Helicopter Mobile Task Force. This proposal expanded earlier Army Aviation School and Infantry School studies of airmobile doctrine to include the tactical use of armed Army aircraft. The school stressed that these weapons were intended only to provide suppressive fires during the assault. At that time, the concept envisioned the use of existing Army aircraft equipped with standard weapons.

The primary objective of the Army Aviation School study was to determine the effectiveness of existing aircraft and weapons in this new role. Following the full evaluation of these concepts, the development of requirements for new or modified equipment and recommendations to higher staff offices would follow. The Army Aviation School was responsible for the details of organization and the methods of employing men and equipment during the evaluation. The Infantry School provided assistance in forming this special force, test problems for inclusion in the program, and observers/umpires to evaluate the tactical feasibility of the concepts.

The 351st Regimental Combat Team, a school troop unit at Fort Rucker, furnished the nucleus of the experimental unit. Aircraft and operating and maintenance personnel were taken from existing resources of the Army Aviation School. The establishment of the composite unit assisted in determining the logistical support demands of this type of unit. Believing it had adequate funds to organize and test the unit, the Army Aviation School made no request for additional money.[5]

The first problem was determining whether existing helicopters could be successfully armed. Colonel Vanderpool, starting work on the project with a cadre of five people, selected the H-13 helicopter as the first test vehicle. The cadre originally had been assigned to Project ABLE BUSTER, and they used armament remaining from the project. By early July, without awaiting General Wyman's formal approval, the first live fire test was conducted using a kit consisting of two .50-caliber machine guns and four Oerlikon 8-cm. rockets.

The tests were conducted with extreme caution since no one knew exactly what would happen when rockets and machine guns were fired from a helicopter. The H-13 was first securely anchored to an elevated wooden platform. The machine guns were fired singly and then in pairs with increasingly long bursts. Inspection revealed that there was no structural damage to the helicopter. The rockets were then fired by remote signal. Test firings both singly and in ripple revealed a much smaller dispersion pattern than had been expected and again no damage to the aircraft. The weapons were then fired while the helicopter hovered and when it was in forward flight at an altitude of approximately 100 feet. Having proven that weapons could be fired successfully from a helicopter, the testers turned their attention to the fabrication and improvement of the armament system.

First attempt to fire rockets from H-13 helicopter.

The Army Aviation School was now ready to study armed airmobile tactical organizations and formations. General Hutton directed Colonel Vanderpool on a Friday afternoon to develop a conceptual sky cavalry—an airmobile tactical force of company size; determine the aircraft requirements; determine troop and pilot requirements; sketch a troop maneuver scenario; assemble the pilots, troops, and aircraft on the parade ground Sunday morning for briefings; and conduct a maneuver Sunday afternoon. Using helicopters taken from the school training fleet, selected instructor pilots were picked and infantrymen were drawn from the school troops. This first exercise demonstrated the potentialities of the concept and during the remainder of 1956 and early 1957, Colonel Vanderpool's group worked on experimental weapons systems during weekdays and experimented with tactics and techniques on weekends when the school was closed. Since funds were not available, these tests were conducted with volunteer pilots from the school.[6]

Aerial Combat Reconnaissance Company

The success of the experiments and tests conducted in 1956 and early 1957 led to the approval of the Army Aviation School recommendation to continue testing of the doctrine, techniques, and tactics of the airmobile concept. On 5 March 1957, the Army Aviation Center directed the organization of a Sky Cavalry Platoon (Provisional) to continue the testing of the concept. On 8 July, this unit, consisting of 11 officers, 16 enlisted men, and 10 helicopters, was placed under the operational control of the Department of Tactics of the Army Aviation School. These people were assigned on special duty, and the equipment was provided on a temporary loan basis.

The Sky Cavalry Platoon was divided into four flights, equivalent to squads. The reconnaissance flight consisted of seven officers and seven aircraft. Six of the aircraft were helicopters, while the seventh was a fixed wing observation plane. The infantry flight was equipped with a cargo helicopter to carry the integral infantry squad. The weapons flight had one officer and one armed utility helicopter. The maintenance section contained five enlisted men and a test engineer. The new platoon, including the experimental armed helicopter, was officially unveiled on 6 June at Fort Rucker before an industrial-military symposium sponsored by the Association of the United States Army.[7]

In order to eliminate the confusion that existed over different types of air cavalry, the unit was redesignated in November 1957 the Aerial Combat Reconnaissance Platoon, Provisional (Experimental). Then, on 24 March 1958, the platoon was expanded to full company size and redesignated the 7292d Aerial Combat Reconnaissance Company (Provisional). The company was organized under TD 92-7292 and assigned the following mission: "To support the Army Aviation School with 100 percent of its personnel and equipment in the conduct of approved training programs and in the development of tactical doctrine, organizational data, operational concepts, materiel requirements, tactics, techniques, and procedures for employment of a completely airmobile combat force." After its reorganization, the unit was placed under the 2d Battle Group, 31st Infantry, as part of the school troops at Fort Rucker. The company

was subsequently redesignated on 25 March 1959 as the 8305th Aerial Combat Reconnaissance Company.[8]

Concurrent with the tactical tests and weapons experimentation, the platoon and later the company held demonstrations before several military and civilian groups. On 27 March 1957, two teams gave the first off-post demonstrations of emerging airmobile tactics before the U.S. Armor Association at Fort Knox and an industrial symposium at Fort Benning. By mid-1957, the platoon had acquired 6 OH-13s, 2 CH-21s, 1 H-25, and 1 UH-19. As mentioned above, an impressive display of experimental weapon systems was presented at the Army Aviation-Industry Symposium conducted at Fort Rucker on 6 June 1957. The demonstration was repeated with some change in armament on 10 June for the Ordnance Association Conference at Redstone Arsenal. Additional demonstrations were conducted during the Joint Civilian Operations Conference at Fort Benning in October 1957 and again in 1958 and at Fort Bliss in July 1958. All of these exercises generated a great deal of command interest in the armed helicopter.[9]

Formal Armament Program

In March 1957, the Chief of Research and Development, Department of the Army, directed the Chief of Ordnance to implement recommendations of the Deputy Chief of Staff for

An H-25 Army Mule helicopter firing a 1.5-inch rocket at Fort Rucker, July 1957.

Operations, Department of the Army, for development of a single machine gun installation on the H-13, H-21, and H-34 helicopters and a 4-gun kit for the YH-40. This represented the first formal program for the development of helicopter armament. Because the helicopter armament program crossed responsibility lines of several agencies, a 3-member steering committee was formed to coordinate and exchange information among the agencies concerned. The committee consisted of representatives from the Office of the Deputy Chief of Staff for Operations, the Chief of Transportation, and the Chief of Ordnance.

This formal adoption of an armament program not only caused concern within the Air Force, but it also met strong objections in the Army staff. The Deputy Chief of Staff for Logistics, Department of the Army, nonconcurred in arming helicopters for tactical use against enemy soldiers and positions. He had no objections, however, to the passive use of helicopter armament to retaliate against enemy ground fire that interfered with the accomplishment of the helicopter's mission. Much of the opposition of the Department of the Army staff was based on the desire not to aggravate the Air Force. Development of an Army attack helicopter would appear to infringe on the Air Force mission of close air support. Theoretically, any armament on Army aircraft was to be for defensive purposes only. Another factor causing a lack of enthusiasm for armed helicopters in certain quarters was the Transportation Corps' view that helicopters should be primarily used for transportation purposes under its control and not as a weapons system in the combat arms. The Chief of Research and Development, Lt. Gen. Arthur Trudeau, and Lt. Gen. Carter B. Magruder, the Deputy Chief of Staff for Logistics, reached a compromise by formally stating that the helicopter was too vulnerable to attack enemy ground forces and that because of its normal low level flying techniques would be unable to locate or hit targets.

By the terms of an agreement reached in July 1957, the Transportation Corps received prime responsibility for the helicopter while the Ordnance Corps was delegated responsibility for the weapons and the weapons systems. The Transportation Corps would handle budgeting and funding, transferring funds to the Ordnance Corps as necessary. The Ordnance Corps would contract for the necessary modifications to the helicopters and for all attachments and mounts that were to be a permanent part of the aircraft. Upon completion of testing, the operational evaluation of the weapons system would be accomplished at Fort Rucker. After the completion of this phase, disposition of the equipment would be made upon instructions from the Deputy Chief of Staff for Research and Development.[10]

In 1958, the Department of the Army directed the development of the single flexible machine gun system. The contract for this first funded project was awarded to the Townsend Company and was supervised by Springfield Armory. The contract resulted in the Townsend fire suppression kit. Another program was begun with the General Electric Company, again supervised by the Springfield Armory, to install a 40-mm. grenade launcher on the H-34A helicopter.[11]

In April 1958, the Ordnance Weapons Command outlined in detail and recommended a series of potential projects in support of Army aviation. Since the Ordnance Weapons Command had furnished liaison officers to Fort Rucker since 1957, it was acquainted with the projects under development concerning the aerial combat reconnaissance company. Fort Rucker had requested

An H-34 armed with 2 20-mm. machine guns, 3 50-caliber machine guns, 6 30-caliber machine guns, 2 pods of 20 2.75-inch rockets, and 2 5-inch rockets.

the Ordnance Corps install two 20-mm. M39 guns on a helicopter for the Army Aviation School and had also made various requests to test rocket launchers. The Ordnance Weapons Command realized that the character of this work and its relationship with Fort Rucker would be greatly improved by providing a formal research and development project with adequate funds.

Areas of great interest at this time were the use of rockets on Army aircraft in an antitank role and upgrading the stability of the gun and rocket platforms. Work in the latter area would provide valuable information for the whole program of improving the accuracy of aerial armament kits. The basic need at the moment, however, was to have an available research and development category where user input could be evaluated and prototypes could be developed.

The Ordnance Weapons Command outlined ten categories to be examined: the fabrication of mounting structures required for installing standard ordnance on Army aircraft; the modification of the aircraft as needed; the simple modifications to the ordnance as required by the installation; the purchase of commercially available ancillary equipment; the fabrication of components to complete the system; the purchase of test quantities of nonstandard munitions not otherwise available; functional testing to determine that the system operated as intended and was safe for

further testing; the conducting of design studies on aircraft armament installations; the conducting of tests of aircraft installations to obtain data for use in systems refinement, for systems effectiveness studies, and to establish parameters of design of complete systems; and the preparation of system performance specifications. The Ordnance Weapons Command sought the appropriation of moderate funds to finance work requested in support of projects at Fort Rucker.[12]

Airborne Troop Test of the SS-10 Missile System

A major area of interest in arming helicopters continued to be the search for a flying antitank weapons system. Testing of various types of ordnance to meet this requirement continued under CONARC direction. In August 1958, the CONARC commander directed the Commanding General, Third Army, the Commandant of the Army Aviation School, and the President of the Army Aviation Board to conduct a troop test for the airborne launching and guidance system for the SS-10 missile.[13] The test was to be conducted at the Army Aviation Center at Fort Rucker and was to be a combined organization and tactical test. Firing demonstrations were also to be conducted at the Armor School and the Infantry School. Equipment required to conduct the test was to be furnished by the Army Aviation Center, except a minimum of two H-13 helicopters to be furnished to the Army Aviation School by the Army Aviation Board. Airborne guidance and launching equipment for the SS-10 missile was to be installed on both helicopters.

The troop test had several objectives. First, it would test doctrine, tactics, techniques and procedures, and concepts for the organization and employment of the airborne-launched SS-10 in support of infantry and armor. Tactics were to include aerial maneuvers used in the attack of a target, to include a comparison between the tactics for the SS-10 and those used with free rockets. Additional modifications desired for the installation of airborne guidance and launching systems on the reconnaissance type helicopter which were not reported during the ordnance safety test and the CONARC Board user service test were to be determined. Information was also needed for the preparation and revision of training literature, technical manuals, and supply bulletins and to ascertain the maintenance support required for the airborne missiles and launching and guidance system. Any reorganization required in the ROCID, ROCAD, and ROTAD divisional aviation company to provide for ground handling and loading of the missile was to be determined, as were training requirements for firing crew and organizational maintenance personnel.

On 10 November 1958, the interim report of the troop test was submitted to CONARC. The content of the report was general in nature, outlining what had been done, what remained to be done, and deficiencies noted in the early phases of the troop test.[14]

CONARC had forwarded to the Department of the Army on 18 July 1958 a proposed qualitative materiel requirement for an armed aircraft weapons system. On 19 December, the Department of the Army stated that action was deferred in view of the Department of Defense policy limiting Army aircraft armament to suppressive fire systems for helicopters.[15]

Adoption of the Armed Helicopter

On 22 July 1959, CONARC sent the Army Aviation School a study directive for Army Aerial Vehicle Weapons System Requirements. The headquarters needed a study that would determine weapon systems requirements for use on Army aerial vehicles. The increasing emphasis placed on these vehicles in support of the field army dictated that they have weapon systems capable of delivering suppressive antitank fires and providing defense against low performance aircraft.

The study was to determine requirements for weapons systems for use on Army aerial vehicles in the 1960-1965 period. The following types of missions were to be considered: aerial combat reconnaissance, aerial tactical troop movement, anti-personnel, antitank, anti-materiel, and defense against low performance aircraft. The systems to be examined included, but were not limited to, automatic weapons, recoilless rifles, guided and ballistic rockets and missiles, electronic control of air and ground launched devices, and infrared, microwave, or other target seeking systems. The system would consider various types of warheads to include those of fractional atomic yield.[16]

On 4 February 1960, CONARC submitted to the Department of the Army a study, which had been held in a deferred status, on the Armed Helicopter Weapon System. The Department of the Army had established a requirement for a system of armament capable of rapid mounting and dismounting on utility helicopters. The armament system could consist of weapons and ammunition from current weapons systems of advanced design, nuclear and nonnuclear, together with synchronized sighting, mounting, and firing devices providing for elevation, depression, and transverse where required. A mounting system would be provided to permit attachment of various combinations of weapons to fit the mission. The system would be employed as an elevated firing platform to support offensive and defensive ground combat operations and provide for full utilization of new weapons and ammunition and the maneuverability of Army helicopters.[17]

On 15 March 1960, the Chief of Research and Development, Department of the Army, assigned to the Transportation Corps the responsibility for coordinating all work of the technical services in developing helicopter weapons for suppressive fire, armor for both aircraft and crew, and equipment for smoke laying, missile guidance, and aircraft stabilization. By the end of FY 1960, the Chief of Research and Development accepted a 10-year program proposed by the Office of the Chief of Transportation as an official guide for future developments. Weapons to be considered for suppressive fire included machine guns, rockets, and missiles.

The first qualitative materiel requirement for armed helicopter weapons systems was approved by the Department of the Army on 16 May 1960 and disseminated by CONARC to interested agencies on 8 June. This qualitative materiel requirement had undergone extensive staffing in CONARC during 1959 and had been forwarded to the Department of the Army on 4 February 1960.[18]

On 21 November 1960, CONARC submitted to the Department of the Army a basis of issue for kits arming the H-13 helicopter with dual machine guns. The following list was approved on 23 December:

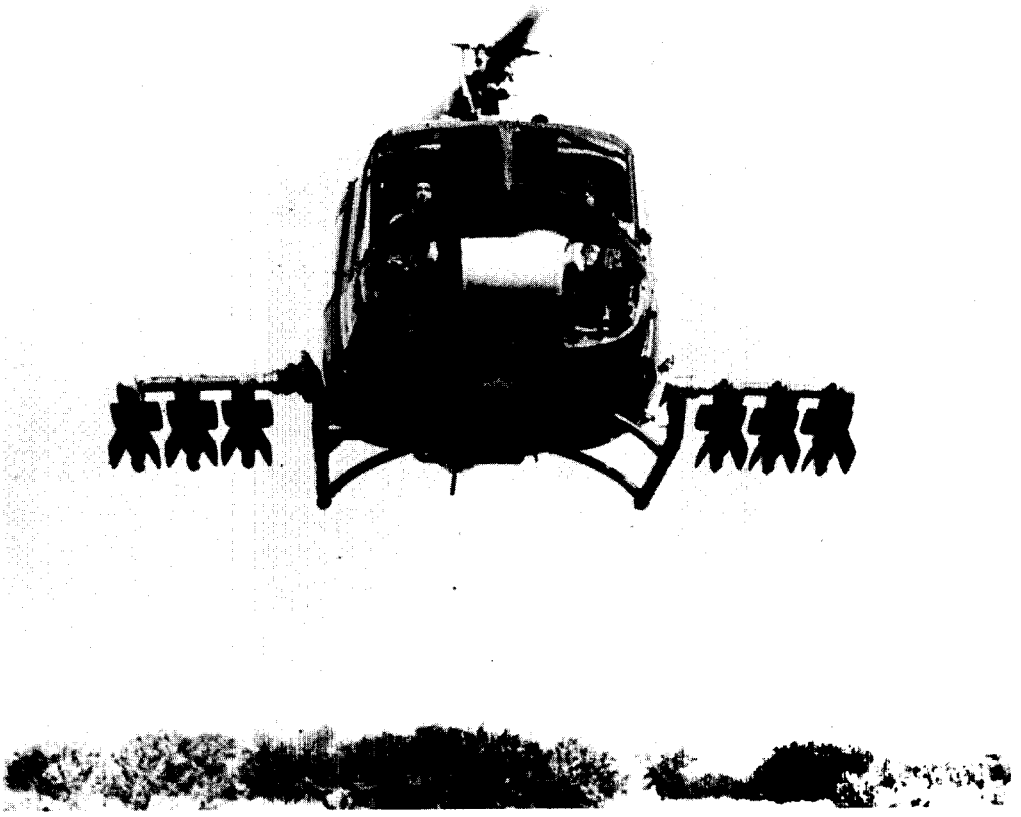
Unit	Quantity
Infantry division	10
Armored division	8
Airborne division	10
Armored cavalry regiment	7
Air cavalry troop	14
Infantry brigade, separate	6
Transportation light helicopter company	2
8305th Aerial Combat Reconnaissance Co	15

This marked the first approval for standard armament on Army helicopters. Also in November, a tentative basis of issue for armament of utility and transport helicopters was submitted to the Department of the Army. The XM138 grenade launcher was proposed to be issued on the basis of one per UH-1 helicopter armed with a wire-guided antitank missile and one per platoon of UH-1 helicopters in the proposed utility tactical transport company. The M153 7.62-mm machine gun kit would be issued one per platoon in the transportation light helicopter company, transportation medium helicopter company, and utility tactical transport company. A procurement order was placed for 150 .30-caliber machine gun kits for the H-13 helicopter and 16 SS-11 missile kits for the UH-1B helicopter. The SS-11 kits were to be delivered to CONARC for the conduct of troop evaluations beginning in January 1962.[19]

CDEC Experiments

A major concern in the development of Army aviation was the vulnerability of low flying aircraft to forward area ground fires. To a great extent, the practicality of the entire emerging airmobile concept depended on the ability of Army aircraft to survive in the forward battle area. The first attempt to answer the vulnerability question was an experiment scheduled to begin at the Combat Development Experimentation Center (CDEC) at Fort Ord on 26 August 1957. The experiment required the use of a considerable number of helicopters. Since Fort Ord could not fill the requirement, it was forwarded to CONARC. As a result, the 33d Transportation Company (Light Helicopter, H-21), augmented by the 573d Transportation Detachment, was moved from Fort Riley to Fort Ord to support this experiment. These units arrived at Fort Ord on 29 June.[20]

Experimentation conducted during FY 1958 was but a prelude to the major work to be conducted in FY 1959. Training of aircraft pilots, umpire troops, and aggressor forces began on 29 July 1957, but owing to the lack of special photographic equipment and a shortage of personnel, the main experiment was postponed until the next fiscal year. A platoon-size experiment was conducted between 17 and 25 September.



UH-1 helicopter armed with SS-11 antitank rockets.

CONARC boards and the Army Ballistics Research Laboratories had already compiled considerable data on the probability of hits and kills, but not on the likelihood that ground troops could detect and react in time to fire. Information on the reaction of ground troops was required to make better judgments about such questions as aircraft armor, suppressive fire, and flight tactics. The experimenters set up trails employing the M-1 rifle, the automatic rifle, the M-42 twin 40-mm. gun, and the M16 dual .50-caliber antiaircraft machine gun. Cameras mounted on the weapons recorded sighting pictures of the target L-19 airplanes and H-21 helicopters at the instant of simulated firing. Results of the experiment were limited by the partial failure of the gun cameras.[21]

In related activity, CDEC assisted the Army Aviation School in preparing an outline plan for tests of a helicopter suppressive fire experiment which was begun on 26 May 1958 and was scheduled for completion on 26 August. A CDEC team of one officer and one scientist participated in the conduct of the experiment. Cameras were used to determine their feasibility as a substitute for the guns on aircraft to determine hits. Concurrently, the Engineer Research and Development Laboratories at Fort Belvoir, Virginia, were investigating the feasibility of

developing infrared devices which could be used to simulate ground-to-air and air-to-ground fire.[22]

As a result of the limited accomplishments of the 1957 experiment at CDEC, CONARC directed a second experiment addressing the same question in broader terms. The latter was to investigate the vulnerability of several types of low flying aircraft, expected to be available to the Army in 1965, to ground fires from aggressor forward battle area weapons during the same period. Types of aircraft employed during the experiment included Army fixed wing and rotary wing, Army experimental jet models, and Air Force F-100Cs. Record runs were conducted at Hunter Liggett Military Reservation between 8 October and 29 November 1958. Low, medium, and high performance aircraft flew at speeds of 75, 200, 325, and 450 knots and at altitudes of contour and 300 feet, in formation of 1, 3, and 9 aircraft, over tactical ground dispositions of representative forward area troops and weapons. Fifty-nine gun cameras mounted on automatic weapons and M-1 rifles exposed some 17,000,000 frames of 16-mm. movie film and 18,000 frames of 35-mm. film, respectively. Also, fifty-nine recorders operated during the record runs to collect time data.

A preliminary report based on a partial analysis was published on 15 June 1959 and distributed in July. The final report was published on 30 November, with distribution in December.

Aircraft participating in the experiment encountered a higher kill probability when operating over areas defended by the REDEYE missile than when operating over areas defended by other types of weapons tested.[23] During periods of good visibility, 75 and 200 knot aircraft operating over open areas in the airspace immediately above the forward edge of the battle area experienced prohibitively high kill probabilities from REDEYE-type weapons. At speeds of 75 and 200 knots, aircraft flying over wooded areas were less vulnerable to REDEYE-type weapons than were aircraft flying over open areas. Only half as many rounds were fired by these missiles in wooded areas as by the same weapon in open areas. Generally, the REDEYE did not have time to fire effectively at aircraft flying at speeds of 325 and 450 knots over wooded areas.

Aircraft flying at 75 knots at both contour and 300-foot altitudes were highly vulnerable to VIGILANTE-type weapons within engagement ranges of 1,200 yards.[24] Vulnerability to these weapons for 200 knot aircraft was less than for the 75 knot aircraft, but was still high. Vulnerability to VIGILANTE-type weapons for 75 and 200 knot aircraft flying at contour altitudes decreased sharply at ranges beyond 1,200 yards.

The capability of conventional hand held weapons to track aircraft was low. Their best performance was achieved against 75 knot aircraft flying at contour altitude and overhead flight paths. In more than 75 percent of the cases in which aggressor gunners were confronted with a sequential combination of aircraft targets, they did not switch or change targets during the course of that run, even when the second aircraft proved to be a more lucrative target.[25]

Based on the above conclusions, the CDEC experimenters recommended the development of effective countermeasures against weapons of the REDEYE and VIGILANTE type and urged

more testing with more variables controlled. The basic conclusion of the report was that low flying aircraft were highly vulnerable to ground weapons.

The CONARC position on the evaluation report was forwarded to the Department of the Army on 16 April 1960. The command had rejected the major conclusion of the report, that low flying aircraft were highly vulnerable to ground weapons, pointing out that criteria of vulnerability such as operating techniques, evasive air tactics, and suppressive fire had not been considered in the experiment. The command concurred in the recommendations of the report with the exception of one which said that Army aircraft should have a speed of 200 knots or better. It was not feasible that all Army aircraft be required to have the capability to fly at speeds in excess of 200 knots, especially light observation aircraft. CONARC recommended that the conclusions of the report not be accepted as final until additional study and experimentation were completed. The report was valuable as a source of data for use by agencies developing future air vehicles. It also provided a measure of the vulnerability problem, thereby furnishing a basis for further study and evaluation.[26]

During the last half of FY 1960, the Combat Operations Research Group (CORG) undertook an unprogrammed study of the survivability of surveillance aircraft in combat use during the 1965-1970 period. Several previous studies had investigated specialized portions of the aircraft survivability problem. In addition, many studies on the subject of survivability of aircraft in a hostile environment had been conducted for the Air Force and the Navy by industry. To the extent possible, existing studies and military judgment were to provide the basic information for the successful completion of the CORG study. Using this information, aircraft performing missions over a hostile environment would be studied to estimate survivability as a function of altitude-speed-terrain parameters. The completed study, forwarded to the Department of the Army on 3 October 1960, supplied planners with estimates of performance characteristics and mission profiles required to produce high survivability rates.[27] It also provided survivability estimates to determine the feasibility of the development of a manned deep penetration aircraft. In addition, the study indicated a plan of future research to fulfill the long range aircraft survivability requirements.

Following CONARC direction, CDEC conducted further experimentation with the REDEYE during April and May 1960. Vulnerability and kill probabilities were not considered. The experiment concentrated on the REDEYE's actual operation performance against aircraft under varied combat conditions. This was followed by an experiment in May and June 1961 at CDEC to determine the capabilities of Army aircraft using evasive tactics to survive in forward areas in which units equipped with REDEYE air defense weapons were operating. The field exercises of the troops were designed to provide a tactical background and realistic battlefield environment for the employment of aircraft and the REDEYE air defense weapons. The combat situations included attack, defense, advance, and rear guard actions; retrograde movements; and bivouac and assembly. The exercises were controlled in accordance with prepared scenarios to the extent necessary to provide the situations for realistic missions of the organic and supporting aircraft. The assigned aircraft missions included reconnaissance, surveillance, resupply and

evacuation, suppressive fires, and airmobile operations. The aviation units and pilots were allowed maximum latitude in selection of routes, use of suppressive fires, evasive tactics and other means to accomplish successfully the assigned missions. The REDEYE teams were employed in accordance with the latest doctrine. They were controlled by their organic or support unit commanders and were subjected as realistically as possible to the normal confusion and distraction of the battlefield.

Once again the air defense weapons scored a high percentage of kills. But it had become increasingly apparent that the findings of the succession of experiments conducted by CDEC since 1957 were considerably biased. The survival of aircraft depended on several factors, and the idealized conditions of these experiments left many of these factors uncontrolled. The aircraft for the most part were not permitted to take the evasive actions which would be expected in combat, and they did not have the opportunity to use suppressive fire. While valid in the context of the stated experimental assumptions, the findings could not be projected to general tactical situations.[28]

During the last half of FY 1961, CDEC conducted an experiment to obtain basic data to be used by Ordnance Corps agencies in feasibility studies of weapons for Army aircraft, weapon design, and fire control equipment requirements. The objective of Phase I of the experiment was to determine the capability to detect ground targets and the types of ground targets most likely to be detected and identified. Also, it was to measure the accuracy of range estimation by an observer without the aid of mechanical ranging devices. Phase II of the experiment measured the ability of the pilot to select from a map the most desirable nap-of-the-earth route to a specific target, to fly a given route, and to identify and attack a specific target. It also measured the accuracy of range estimation by the pilot without the aid of mechanical range finders and the capability of an observer to locate, identify, and report location while flying nap-of-the-earth.

Within an area of eight square kilometers, various types of equipment were placed in defensive positions. The targets were located on preselected positions and utilized natural cover and camouflage to avoid detection from project aircraft. During Phase I of the experiment, helicopters entered the target area from eight different points and flew an S-shaped pattern across the target area on a predetermined flight path. During the course of the flight, a photographic aircraft flew above the project helicopter. Upon notification of a target detection and identification by the observer, a photo was taken recording the helicopter's position at the time. Radio communication from the pilot, and by the control agencies, were taped and time recorded. During Phase II of the experiment, each pilot was given a mission of locating and destroying a specific target while flying a given course at nap-of-the-earth level. Again, a photo aircraft took pictures of the project helicopter during the entire flight and a pen scriber and tape recorder at the control center recorded times and actions during the flight. Firing on the specific target was simulated and recorded by gun-type camera activated by the pilot. The project aircraft did not attack targets of opportunity, but an observer in the aircraft recorded the location of such targets as the pilot pointed them out. All data collected in this experiment were released to the Ballistic

Research Laboratories, Aberdeen Proving Ground, for subsequent analysis and submission of a final report.[29]

During the fall of 1961, the Combat Developments Experimentation Center conducted a helicopter armament range estimation experiment. This experiment represented an extension of the previous helicopter armament experiment and was to obtain basic data on the capability of air observers to estimate range. Data accumulated were used by Ordnance Corps agencies in subsequent feasibility studies of weapons and fire control equipment for Army aircraft.

The experiment had three objectives. First, to determine the accuracy with which an observer or pilot using the "pop-up" technique could estimate the slant range from a helicopter to a ground target from three different altitudes. Second, to determine the accuracy with which an observer could initially estimate the slant range to a target while in forward flight at three different altitudes. Finally, to determine the accuracy of sequential range estimates made while closing on a target, again at three different altitudes.

The Human Engineering Laboratories, Aberdeen Proving Ground, provided Ordnance Corps personnel for project coordination and guidance during planning, training, and field experimentation and established the data collection requirements. This organization also analyzed the data collected. The Commanding General, CDEC, was responsible for the design and conduct of the experiment.

On three different record courses, panels were placed at varying distances from targets to a maximum range of 2,200 meters. Eighteen pilots acting as observers were flown over each record course twice, once using pop-up technique and once on a straight run to target. Each observer estimated from a prescribed altitude the range to the target as he passed over the panels along each of the courses. An after action report was forwarded to CONARC on 12 October 1961.[30]

Army Aircraft Armament Ad Hoc Committee

At the conclusion of a briefing on 26 April 1961, Lt. Gen. Gordon B. Rogers, the acting Commanding General, CONARC, requested that the CONARC DCSOPS provide him with the current status of Army aircraft armament systems and recommended actions to expedite procurement and issue of these systems to troops. On the following day, General Herbert B. Powell, the Commanding General, CONARC, directed the formation of a CONARC Ad Hoc Committee to Study the Army Aircraft Armament Program. General Powell recommended to the Chief of Staff of the Army action to expedite procurement and issue of required armament kits and ammunition and the establishment of an early Department of the Army/CONARC conference to resolve these problems. On 10 and 12 May, a preliminary committee developed terms of reference and a draft directive to establish an ad hoc committee. On 13 June, Maj. Gen. Louis W. Truman, the CONARC Deputy Chief of Staff for Operations, Plans, and Training presented CONARC recommendations at a Department of the Army/CONARC conference in the Pentagon. The directive establishing the Army Aircraft Armament Ad Hoc Committee was approved by the commanding general on 16 June. Definitive CONARC quantitative requirements

for Army aircraft armament systems and ammunition were presented at the second Department of the Army/CONARC conference by General Truman on 27 June, and the ad hoc committee convened for the first time on 29 June at Fort Monroe.[31]

During the period, July through August, Maj. Gen. T.F. Van Natta, the CONARC Deputy Chief of Staff for Combat Developments, chaired an ad hoc committee which was to determine requirements and establish implementing procedures for Army aircraft armament systems for the period 1961 to 1970. The following areas were considered: missions of armed aircraft; type and number of aircraft to be armed; caliber and type of armament for each aircraft recommended; personnel, materiel, and facility support requirements for testing, operations, and training; and ways and means of expediting the development, testing, procurement, and issue to troops of the present armament systems.

The final report was submitted to the commanding general on 26 August. General Powell submitted it to the Department of the Army on 1 September, recommending approval. Among other things, the report recommended machinegun, antitank guided missile, rocket, and grenade launcher armament for helicopters within the Army's combat divisions and armored cavalry regiments, as they were reorganized under the ROAD concept, and certain armament for the MOHAWK fixed wing aircraft.[32]

Chief among the CONARC revisions was the deletion of the antitank guided missile and rocket-armed helicopters from the reorganized divisions in favor of an armed helicopter unit at the corps level. CONARC also recommended the reduction in the weight of the armed observation helicopter by use of a one-gun system as a follow-on to the dual machinegun system currently in production.

The Department of the Army approved the modified report for planning on 1 December. On 29 December, the Department of the Army decisions and comments on the report were presented in a briefing to General Powell. Subsequently distributed by CONARC to the CONUS army commanders and selected Department of the Army agencies in the form of a memorandum for record, the briefing represented a consolidation of the Department of the Army/CONARC position on the requirements for Army aircraft armament.

The committee's report dealt with requirements for three time frames. The briefing for General Powell on 29 December dealt in some detail with the requirements for FY 1961 through FY 1963 and discussed only in general terms the requirements for FY 1964-1966 and FY 1967 and beyond. For FY 1961-1963, four weapons systems were discussed, including appropriate Department of the Army production and procurement plans.

The basis of issue of the XM-1 machinegun system for the observation helicopter within the reorganized combat divisions was 6 for the aviation battalion, 10 for division artillery, 10 per cavalry squadron, and 6 for each of the three brigades. Issue of 150 of the XM-1 machinegun kits was to take place between January and June 1962. In addition, CONARC recommended procurement of 200 kits with FY 1962 funds and 168 with FY 1963 funds. This quantity, allowing for anticipated helicopter shortages, was described as sufficient to equip 14

divisions, 2 brigades, and 5 armored cavalry regiments while satisfying school training requirements for the armed observation helicopter by FY 1964.

The basis of issue of the SS-11 antitank guided missile mounted on the UH-1B helicopter was three per general support company of the aviation battalion and four per air cavalry troop. Sixteen limited production SS-11 systems were to be issued for troop evaluation during March and April 1962. CONARC recommended the purchase of an additional 84 systems and 14,000 missiles during FY 1962 and FY 1963.

The basis of issue of the 2.75-inch rocket mounted on the UH-1B helicopter was the same as the SS-11 system. Complete development and production of the 2.75-inch rocket system could not be accomplished prior to March 1963. To meet immediate high priority requirements, however, limited production 2.75-inch rockets mounted on H-34 helicopters could be made available in June 1962. CONARC recommended procurement of 100 2.75-inch rocket systems for FY 1962 and FY 1963.

The basis of issue of the XM-153 quad machinegun system mounted on the UH-1B helicopter was nine per air cavalry troop. This system was still under development with 125 systems programed and funded through FY 1963.

CONARC noted that if the various follow-on procurement plans were affected in fiscal years 1962 and 1963, in accordance with its recommendations, the Army would progressively have sufficient armed helicopters to support requirements of the Special Warfare Center, equip ten combat divisions and four non-divisional air cavalry troops, and satisfy CDEC and school requirements.

In addition to the four weapons systems discussed above, the ad hoc committee's recommendations for arming the MOHAWK airplane were under consideration by the Department of the Army and would be handled as a separate action. In this connection, since October 1960 the Army Aviation Board at Fort Rucker had accumulated sufficient information to begin testing the MOHAWK with the armament proposed in the ad hoc committee report. Testing would begin upon receipt of the Department of the Army approval.

The briefing of General Powell concluded with a summarization of the actions which CONARC was currently taking, or proposed to take at an early date, for implementing those portions of the Army Aircraft Requirements report which had been approved by the Department of the Army. TOEs were to be revised to reflect changes in quantities of aircraft armament prior to submission of the final reorganized (ROAD) division TOEs to the Department of the Army. A concept for an aerial weapons unit at corps level had been developed and was to be tested in war games. Revisions of qualitative materiel requirements and military characteristics to reflect concept changes stemming from the recommendations of the ad hoc committee report would have to be made. In coordination with the Chief Chemical Officer, further development of requirements for aircraft-mounted CBR weapons was necessary.

At the conclusion of the briefing, General Powell stated that CONARC should recommend sufficient quantities of aircraft armament to the Department of the Army to equip sixteen

divisions. He also stated that CONARC should reopen, with the Department of the Army, the need for further procurement of H-34 helicopters to alleviate serious shortages.[33]

The report of the ad hoc committee provided a firm basis for establishment of a comprehensive program for arming Army aircraft. It served as a guide to Department of the Army agencies for preparing research and development plans and distribution schedules of aircraft armament systems. The published working papers of the committee provided a compilation of data pertinent to the subject of arming Army aircraft. The report of the CONARC Ad Hoc Committee to Study Army Aircraft Armament Systems, along with the report of the Rogers Committee on Army Aviation, provided the basis on which the Howze Board in 1962 was to revolutionize Army aviation.

Department of the Army approval of the recommendations of General Powell in regard to a program for arming Army aircraft provided a firm basis for development of qualitative materiel requirements for Army aircraft armament systems. Accordingly, CONARC directed on 26 December that qualitative materiel requirements be prepared by the Army Aviation School with the assistance of the Army Aviation Board. Five distinct qualitative materiel requirements (QMR), were to be developed for the following armament systems: light weapons, area weapons, point weapons, air-to-air weapons, and a target marking system. These QMRs were to replace the existing ones for an Army helicopter weapons system.

As finally developed, the air-to-air weapons system was dropped and the Army helicopter weapons system was revised. The five qualitative materiel requirements were forwarded to the Chief of Research and Development, Department of the Army, on 21 May 1962. The revised QMR for the armed helicopter weapons system was an updating of the existing version to include the weapons which were currently programmed. An area weapons system was proposed to be mounted on Army utility helicopters and used in support of ground combat operations to deliver area fires against such targets as groups of men and vehicles and supply installations. This system was to be a follow-on to the existing 2.75-inch rocket. The proposed light weapons system provided for a reliable, lightweight armament for installation on selected Army aircraft would be used for marking tactical targets for air strikes and other fire support means. Finally, the proposed QMR for point weapons systems provided two distinct, reliable, light-weight armament systems for installation on Army utility helicopters for the mission of destruction of such point targets as armored vehicles, unarmored vehicles, and fixed emplacements. These would be an anti-heavy armor and an anti-light armor system. These systems were to be a follow-on for the SS-11 missile and 20-mm. gun.[34]

Armament and Airmobility

The development of aircraft armament by the Army was to change the orientation of Army aviation completely. Until the successful mounting of weapons on helicopters and light airplanes took place, Army aviation had been limited to a role of logistical support and aerial observation. The emphasis on transport aircraft had naturally led to a dominant position in the

aviation field of the Transportation Corps. With the acceptance of the armed helicopter and the shift toward combat operations, CONARC became the focal point of aviation developments.

Many Army officers had long envisioned a much broader mission for Army aviation. General Matthew Ridgway, Maj. Gen. James Gavin, and Maj. Gen. Hamilton Howze all put forth concepts for the use of light aviation directly in combat operations. The realization of these concepts depended on two things—the provision of proper aircraft and the arming of Army aircraft.

Experiments with armament actually began before the new aircraft entered service. The speed with which a successful helicopter armament system was developed resulted from the imagination and dedication of such officers as Brig. Gen. Carl Hutton and Colonel Jay Vanderpool rather than of a concerted Army directed development program.

At about the same time that development of aircraft armament began, a new doctrine and organization for Army aviation began to evolve. In the following chapter we will trace the growth of the airmobility concept. The introduction of the aircraft needed to implement this concept will be covered in a later chapter.

Endnotes

Chapter X

1. Weinert, *Army Aviation*, pp. 39-40, 42.

2. (1) Leonard C. Weston and Clifford W. Stephens, *The Development, Adoption, and Production of Armament for Army Helicopters, 1957-1963*, HQ US Army Armament Command, Pt I, pp. 22-30 (hereafter cited as Weston and Stephens, *Helicopter Armament*). (2) CONARC Summary of Major Events and Problems, FY 55, Vol. VIII, Cbt Dev Sec Gen Div, Jan-Jun 55, pp. 7-8. (3) History of US Army Aviation Center and Army Aviation School, 1954-1964, pp. 52-53.

3. CONARC Summary of Major Events and Problems, FY 56, Vol. IV, Cbt Dev Sec Gen Div, Jul-Dec 55, pp. 3-4.

4. (1) CONARC Summary of Major Events and Problems, FY 56, Vol. VI, G-3 Sec Tng Div Gen Tng Br, Jan-Jun 56, p. 7. (2) Lt Col Charles O. Griminger, "The Armed Helicopter Story," *United States Army Aviation Digest*, Pt I, Jul 71, pp. 15-17. (3) Col Jay D. Vanderpool, "We Armed the Helicopter," *United States Army Aviation Digest*, Jun 71, p. 4. (4) Lt Gen John J. Tolson III, *Airmobility, 1961-1971* (Washington: Department of the Army, 1973), p. 6. (5) Ltr, Brig Gen Carl I. Hutton, Cmdt Army Avn School, to General W. G. Wyman, CG CONARC, 27 Jun 56. (6) Ltr, Wyman to Hutton, 13 Jul 56. (7) Weston and Stephens, *Helicopter Armament*, Pt I, pp. 3-5.

5. Weston and Stephens, *Helicopter Armament*, Pt I, pp. 5-8.

6. (1) US Army Aviation Center History, 1954-1964, p. 53. (2) Vanderpool, "We Armed the Helicopter," pp. 4-6. (3) Griminger, "The Armed Helicopter Story," Pt I, pp. 16-17. (4) Weston and Stephens, *Helicopter Armament*, Pt I, pp. 8-17.

7. Weston and Stephens, *Helicopter Armament*, Pt I, pp. 18-19.

8. (1) Vanderpool, "We Armed the Helicopter," pp. 27-28. (2) Griminger, "The Armed Helicopter Story," Pt II, *United States Army Aviation Digest*, Aug 71, p. 15. (3) Army Aviation Center History, pp. 16, 53.

9. (1) Griminger, "The Armed Helicopter Story," Pt II, pp. 17-18. (2) Army Aviation Center History, pp. 53-54.

10. (1) Weston and Stephens, *Helicopter Armament*, Pt I, pp. 80-86. (2) Griminger, "The Armed Helicopter Story," Pt III, *United States Army Aviation Digest*, Sep 71, p. 11.

11. Weston and Stephens, *Helicopter Armament*, Pt I, pp. 91-92; Pt II, pp. 18-41; Pt III, pp. 1-A9—1-B5.

12. (1) Weston and Stephens, *Helicopter Armament*, Pt I, pp. 91-95. (2) Griminger, "The Armed Helicopter Story," Pt III, p. 11.

13. The SS-10 was a wire-guided antitank rocket developed by the French.

14. (1) CONARC Summary of Major Events and Problems, FY 59, Vol. III, Army Avn Sec, Jul-Dec 58, pp. 3-4. (2) Vanderpool, "We Armed the Helicopter," pp. 26-27.

15. CONARC Summary of Major Events and Problems, FY 60, Vol. V, Army Avn Sec, Jan-Jun 60, p. 18.

16. (1) CONARC Summary of Major Events and Problems, FY 60, Vol. VI, Cbt Dev Sec Gen Div, Jul-Dec 59, pp. 15-16. (2) Warheads of fractional atomic yield referred to small tactical weapons of less than one kiloton power.

17. CONARC Summary of Major Events and Problems, FY 60, Vol. VI, Cbt Dev Sec Gen Div, Jan-Jun 60, pp. 14-15 (CONFIDENTIAL—Info used is UNCLASSIFIED).

18. (1) OCofT, Summary of Major Events and Problems, FY 60, pp. 102-103. (2) CONARC Summary of Major Events and Problems, FY 60, Vol. V, Army Avn Sec, Jan-Jun 60, p. 18. (3) Griminger, "The Armed Helicopter Story," Pt III, *United States Army Aviation Digest*, p. 10.

19. (1) CONARC Summary of Major Events and Problems, FY 61, Vol. VI, Avn Sec, Jul-Dec 60, pp. 6-7. (2) DA DCSOPS Dir of Army Avn, Summary of Major Events and Problems, FY 61, p. B-II-1 (TOP SECRET—Info used is UNCLASSIFIED).

20.CONARC Summary of Major Events and Problems, FY 57, Vol. VI, USA Cbt Dev Exp Ctr, Jan-Jun 57, p. 20.

21. John L. Romjue, *Combat Developments Questions Answered Through Field Experimentation 1956-1971,* USA CDEC, Aug 72, pp. 112-114 (hereafter cited as Romjue, *Field Experimentation*) (SECRET—Info used is UNCLASSIFIED).

22. CONARC Summary of Major Events and Problems, FY 58, Introductory Narrative, Ch. V, pp. 40-41.

23. REDEYE, man-portable and shoulder-fired, was the smallest guided missile system that gave the soldier an effective defense against low flying aircraft.

24. The VIGILANTE was a 37mm 6-barrel gatling gun mounted on a tank chassis or trailer with a 15,000-foot range and firing rate of 48 rounds per second.

25. CONARC Summary of Major Events and Problems, FY 60, Vol. VI, USA Cbt Dev Exp Ctr, Jul-Dec 59, pp. 9-13.

26. (1) CONARC Summary of Major Events and Problems, FY 60, Vol. VI, Cbt Dev Sec Gen Div, Jan-Jun 60, p. 16. (2) Romjue, *Field Experimentation,* pp. 115-117 (SECRET—Info used is UNCLASSIFIED).

27. (1) CONARC Summary of Major Events and Problems, FY 60, Vol. VI, Cbt Dev Sec Gen Div, Jan-Jun 60, pp. 13-14. (2) CONARC Summary of Major Events and Problems, FY 61, Vol. VII, Cbt Dev Sec CA Div, Jul-Dec 60, p. 7.

28. (1) CONARC Summary of Major Events and Problems, FY 61, Vol. VIII, USACDEC, Jan-Jun 61, pp. 21-23. (2) Romjue, *Field Experimentation,* pp. 118-120.

29. CONARC Summary of Major Events and Problems, FY 61, Vol VIII, CDEC, Jan-Jun 61, pp. 23-25.

30. CONARC Summary of Major Events and Problems, FY 62, Vol. VII, CDEC, Jul-Dec 61, pp. 10-11.

31. CONARC Summary of Major Events and Problems, FY 61, Vol. IV, G-3 Sec Doc & Req Div, Jan-Jun 61, pp. 13-14.

32. (1) Ibid., FY 62, Vol. III, DCSOPS Doc & Req Div, Jul-Dec 61, p. 22, and Vol. VII, DCSCD, Cbt Arms Div Tac Br, Jul-Dec 61, pp. 7-8. (2) DA DCSOPS Dir of Army Avn, Summary of Major Events and Problems, FY 61, p. B-II-1 (TOP SECRET—Info used is UNCLASSIFIED).

33. (1) CONARC Summary of Major Events and Problems, FY 62, Vol. VI, Avn Sec, Jul-Dec 61, pp. 1-5. (2) Ltr ATAVN 350, CONARC to distr, 22 Jan 62, subj: Briefing of CG, USCONARC on Army Aircraft Armament.

34. CONARC Summary of Major Events and Problems, FY 62, Vol. VII, DCSCD Cbt Arms Div Tac Br, Jul-Dec 61, p. 10, and Jan-Jun 62, pp. 1-2.